WE CLAIM:

1. A thermally-integrated low temperature water-gas shift reactor for converting carbon monoxide in the presence of steam to form carbon dioxide and water comprising, in combination,

a) a waste-heat recovery steam generator for the beneficial recovery of exothermic reaction heat to generate steam that is used in a process for the conversion of hydrocarbon feedstock into hydrogen-rich gases,

b) an outer region extending about said waste-heat steam generator,

c) a catalyst bed located within said outer region, and through which reformate gases flow,

d) the outer region being in heat transfer communication with the steam generator to maintain the catalyst bed within a predetermined temperature range for operation of a low temperature shift reaction.

2. The combination of claim 1 wherein the waste heat steam generator operates at temperatures in one of the following ranges: 360°F to 450°F, and of 385°F to 400°F, that is optimum for conducting the low temperature water-gas shift reaction.

3. The combination of claim 1 wherein a Cu/Zn catalyst is contained in an annular space defined by said outer region, and having an inner wall that is in thermal contact with a boiling water fluid in said generator.

4. The combination of claim 3 wherein the boiling water fluid is located to transfer heat to the catalyst bed to heat the bed during start-up.

5. The combination of claim 3 wherein the catalyst bed is located to transfer heat to the boiling water fluid during normal operation to generate steam.

6. The combination of claim 1 including longitudinal heat transfer fins attached to an inside wall of the annulus and projecting in said bed to enhance the rate of heat transfer to and from the catalyst bed.

7. The combination of claim 1 including a helical coil adjacent the inner and outer walls for defining annular space at said annulus to conduct and increase the velocity of the process gases as they flow through the catalyst bed and to enhance the rate of heat transfer to and from the catalyst bed.

8. The combination of claim 1 wherein the catalyst bed is maintained in one of the following ranges: between 370°F and 550°F, and between 400°F and 450°F.

9. The combination of claim 3 wherein the annular space is typically between 1 and 2 inches wide to minimize temperature differentials between the outside and inside walls defined by the annular space.

10. The combination of claim 3 wherein the gas has hourly space velocity in the range of 500hr-1 to 2000hr-1.

11. The combination of claim 1 wherein the waste heat stem generator contains one or more heat transfer conduits that transfer heat from hot combustion products to a boiling water fluid for the purpose of generating steam.

12. The combination of claim 1 wherein the steam generator includes an upright vessel, said outer region having an upper level inlet flowing reformate into the catalyst bed, the reformate containing carbon monoxide, and said region having a lower level outlet, a catalyst bed located between said upper and lower levels, a heat transfer conduit or conduits extending within said vessel and immersed within boiling water contained in said vessel inwardly of said catalyst bed, said conduit or conduits receiving hot products of combustion from a combustion process, for transfer of heat to the boiling water, for generating steam exiting from said vessel.

13. The combination of claim 1 wherein the catalyst bed extends helically about said generator.

14. The combination of claim 1 including a helical coil in said outer region and extending about said generator, to direct said reformate gases helically and through said catalyst bed, to enhance heat transfer via said bed.